FIG. 1

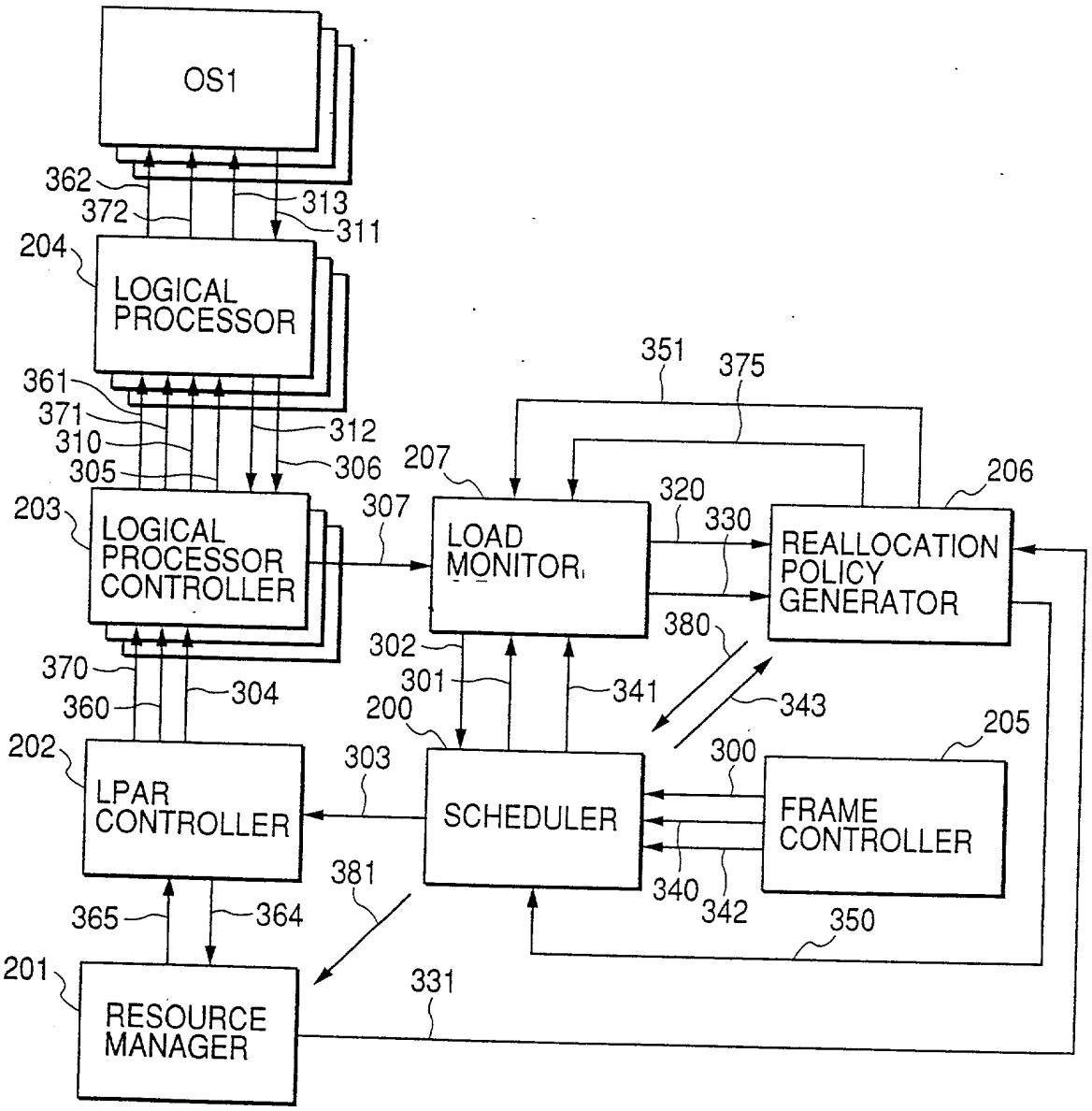

OS1
362
372
313
311
204
LOGICAL PROCESSOR
361
371
310
305
312
306
351
375
207
320
330
206
203
LOGICAL PROCESSOR CONTROLLER
307
LOAD MONITOR
REALLOCATION POLICY GENERATOR
380
302
301
341
343
370
360
304
200
205
202
LPAR CONTROLLER
303
SCHEDULER
300
FRAME CONTROLLER
381
340
342
350
365
364
201
RESOURCE MANAGER
331

FIG. 2

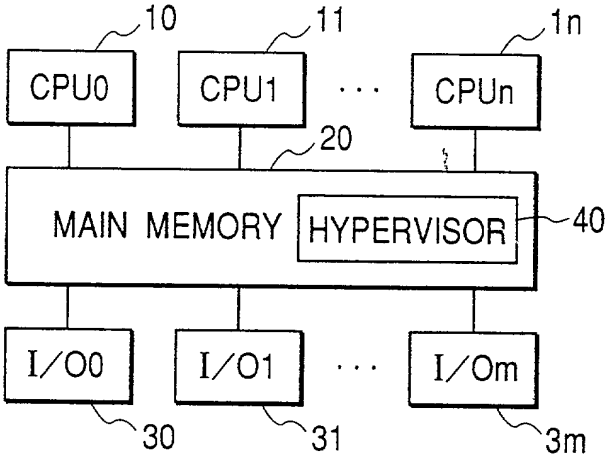

10
11
1n
CPU0
CPU1
CPUn
20
MAIN MEMORY
HYPERVISOR
40
I/O0
I/O1
I/Om
30
31
3m

FIG. 3

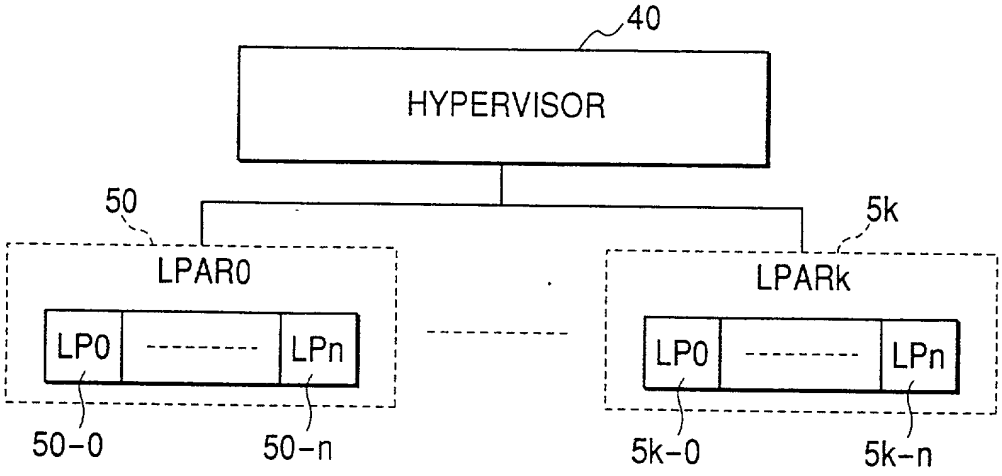

40
HYPERVISOR
50
5k
LPAR0
LPARk
LP0
LPn
LP0
LPn
50-0
50-n
5k-0
5k-n

FIG. 4

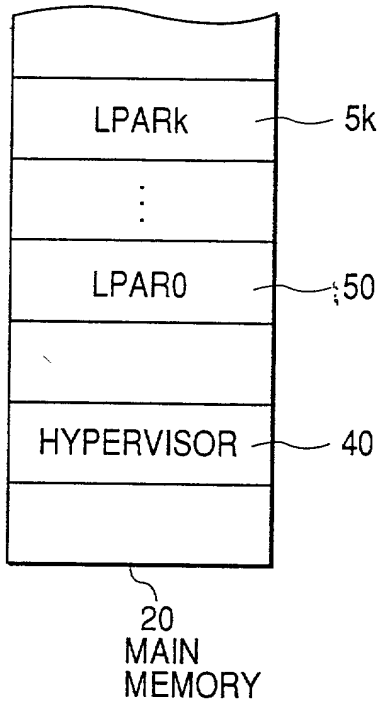


FIG. 5

101 LPAR NAME	102 START ADDRESS	103 MAIN MEMORY SIZE	104 CPU ALLOCATION [%] CPU0	CPU1	···	CPUn
LPAR0	a	m1	100	50	···	—
⋮						
LPARk	i	mk	—	50	···	100

100
LPAR INFORMATION TABLE

FIG. 6

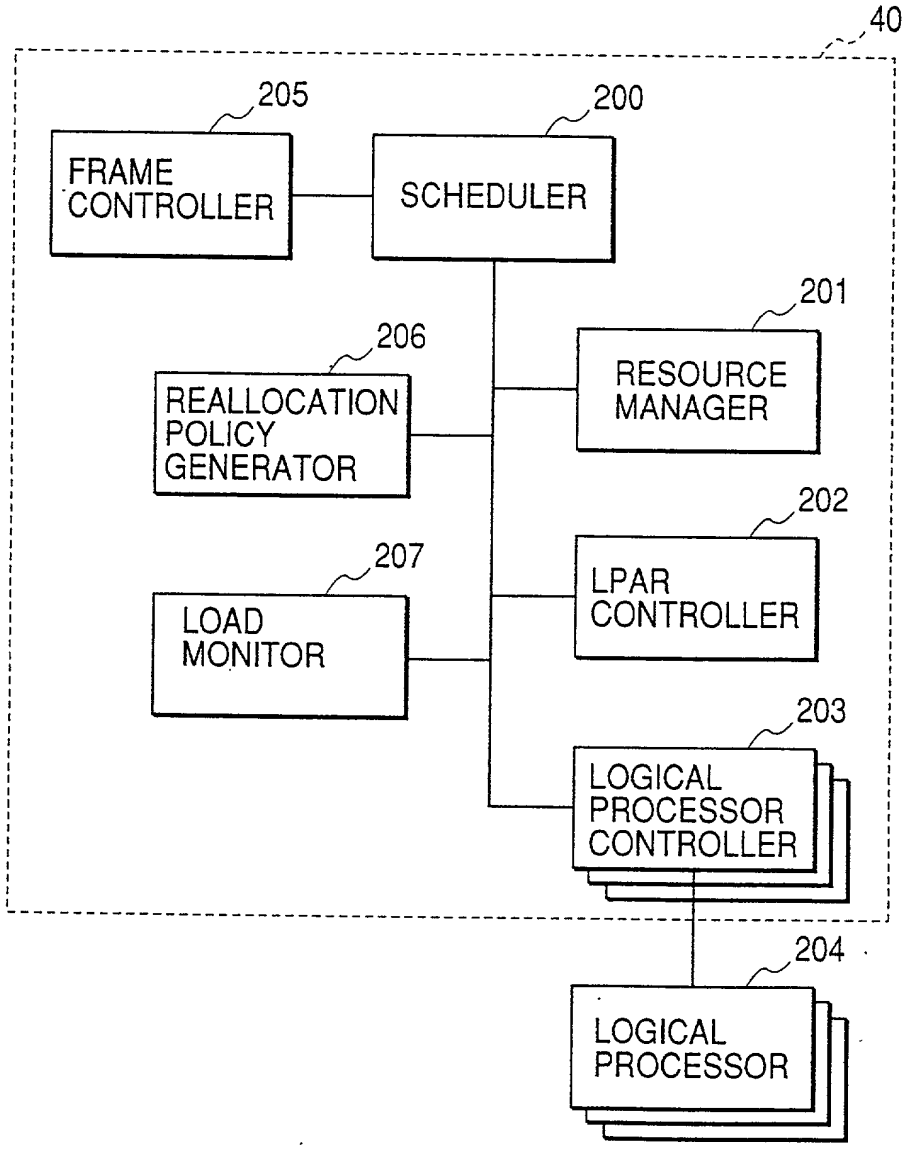

40
205
FRAME CONTROLLER
200
SCHEDULER
201
RESOURCE MANAGER
206
REALLOCATION POLICY GENERATOR
202
LPAR CONTROLLER
207
LOAD MONITOR
203
LOGICAL PROCESSOR CONTROLLER
204
LOGICAL PROCESSOR

FIG. 7

CPU ALLOCATION (%)

	CPU0	CPU1	CPU2	CPU3
LPAR0	100	50		
LPAR1		50	100	
LPAR2				100

FIG. 8

CPU LOAD

	CPU OCCUPATION RATE (%)/QUEUE LENGTH			
	CPU0	CPU1	CPU2	CPU3
LPAR0	100/5	100/4	—	—
LPAR1	—	10/0	5/0	—
LPAR2	—	—	—	20/0

FIG. 9

NEW CPU ALLOCATION PLAN (%)

	CPU0	CPU1	CPU2	CPU3
LPAR0	100	75	50	30
LPAR1		25	50	
LPAR2				70

900

REALLOCATION POLICY TABLE

FIG. 10

ACTION TABLE

STATUS	PRIORITY	COUNTERMEASURE
OPU OCCUPTION RATIO IS HIGHER THAN IT'S THRETHOLD AND QUEUE LENGTH IS LONGER THAN IT'S THRESHOLD	1	INCREASE OF CPU ALLOCATION TIME AND ADDITION OF A CPU WHICH IS IN IDLING STATE
	2	ADDITION OF A CPU WHICH IS IN IDLING STATE
	3	INCREASE OF CPU
	⋮	
OPU OCCUPTION RATIO IS HIGHER THAN IT'S THRETHOLD AND QUEUE LENGTH IS NOT LONGER THAN IT'S THRESHOLD	1	ALLOCATION TIME
	2	ADDITION OF A CPU WHICH IS IN IDLING STATE
	⋮	
⋮	⋮	

FOR 2005-1-5 15:45:50

FIG. 11

CPU OCCUPATION RATIO (%) OF OFFERING LPAR	RATIO OF CPU ALLOCATION TIME TO BE RELEASED-FOR ANOTHER LPAR (%)
0～10	50
10～20	40
20～30	30
30～40	20
40～	0

(CPU ALLOCATION TIME TO BE RELEASED)=(PRESENT CPU ALLOCATION TIME) ×(RATIO OF CPU ALLOCATION TIME TO BE RELEASED FOR ANOTHER LPAR)

FIG. 12

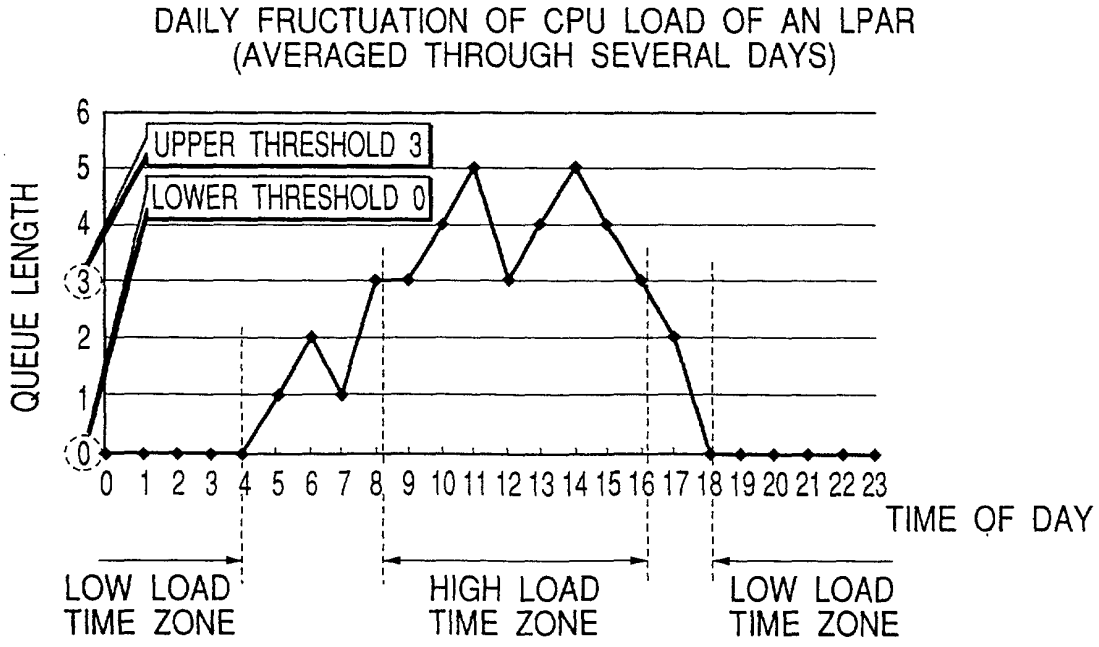


FIG. 13

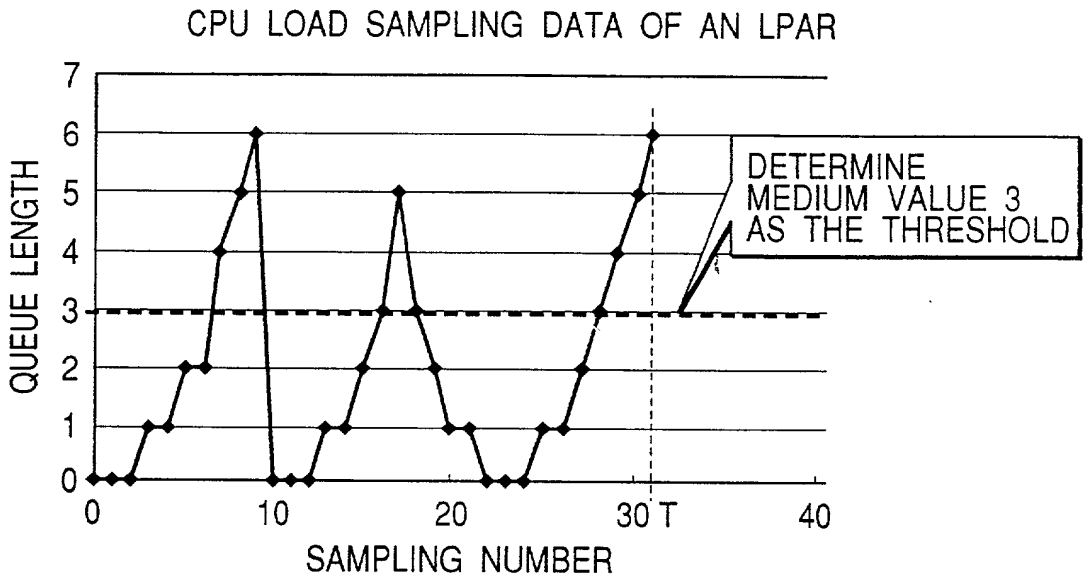

CPU LOAD SAMPLING DATA OF AN LPAR
QUEUE LENGTH
SAMPLING NUMBER
DETERMINE MEDIUM VALUE 3 AS THE THRESHOLD
0
1
2
3
4
5
6
7
0
10
20
30 T
40

FIG. 14

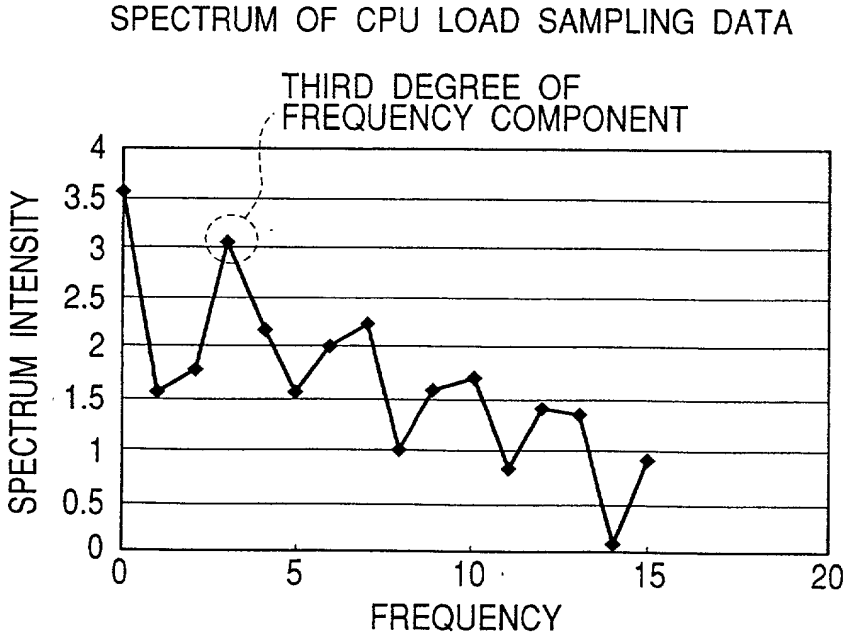

SPECTRUM OF CPU LOAD SAMPLING DATA
THIRD DEGREE OF FREQUENCY COMPONENT
SPECTRUM INTENSITY
FREQUENCY
0
0.5
1
1.5
2
2.5
3
3.5
4
0
5
10
15
20

FIG. 15

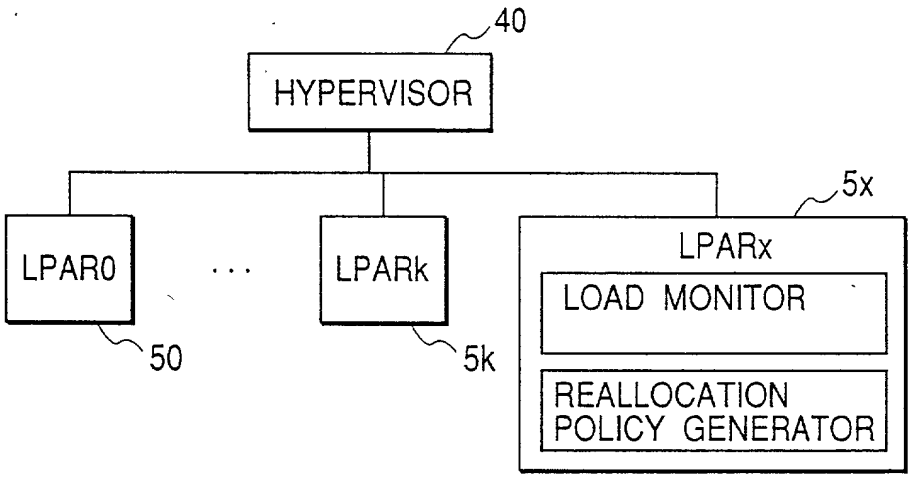

40
HYPERVISOR
5x
LPAR0
LPARk
LPARx
LOAD MONITOR
REALLOCATION POLICY GENERATOR
50
5k

FIG. 16

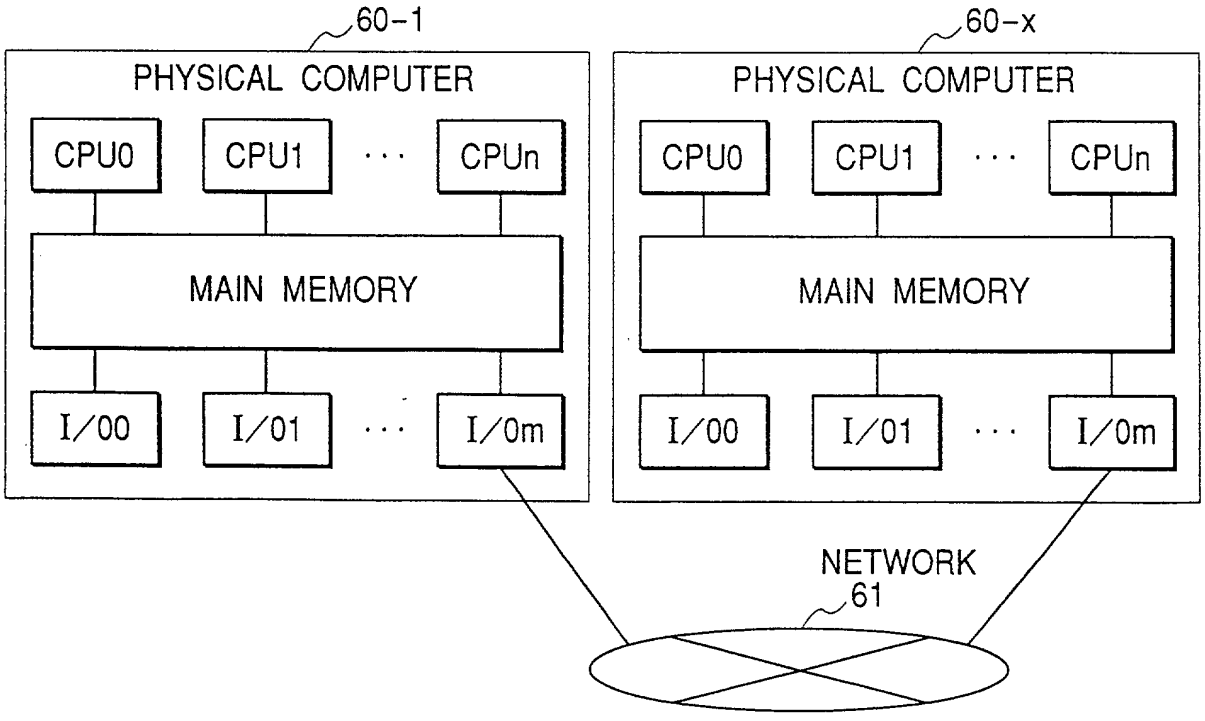

60-1
PHYSICAL COMPUTER
CPU0
CPU1
CPUn
MAIN MEMORY
I/00
I/01
I/0m
60-x
PHYSICAL COMPUTER
CPU0
CPU1
CPUn
MAIN MEMORY
I/00
I/01
I/0m
NETWORK
61

FIG. 17

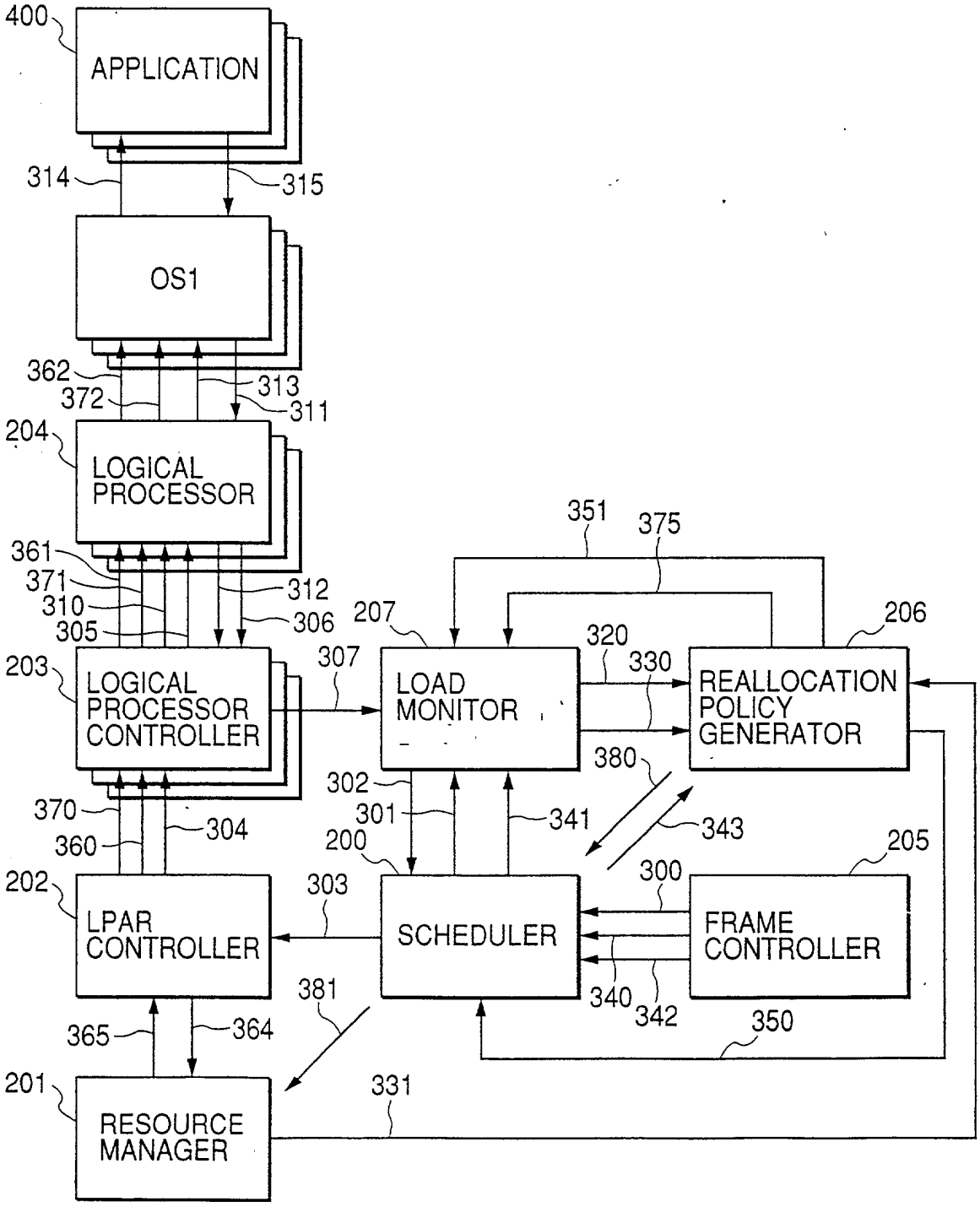

400
APPLICATION
314
315
OS1
362
372
313
311
204
LOGICAL PROCESSOR
361
371
310
305
312
306
351
375
207
206
320
330
307
203
LOGICAL PROCESSOR CONTROLLER
LOAD MONITOR
REALLOCATION POLICY GENERATOR
380
302
301
341
343
370
360
304
200
205
300
202
LPAR CONTROLLER
303
SCHEDULER
FRAME CONTROLLER
340
342
381
365
364
350
201
RESOURCE MANAGER
331

FIG. 18

MEAN APPLICATION RESPONSE TIME

	MEAN RESPONSE TIME (sec.)
LPAR0	10
LPAR1	2
LPAR2	3

FIG. 19

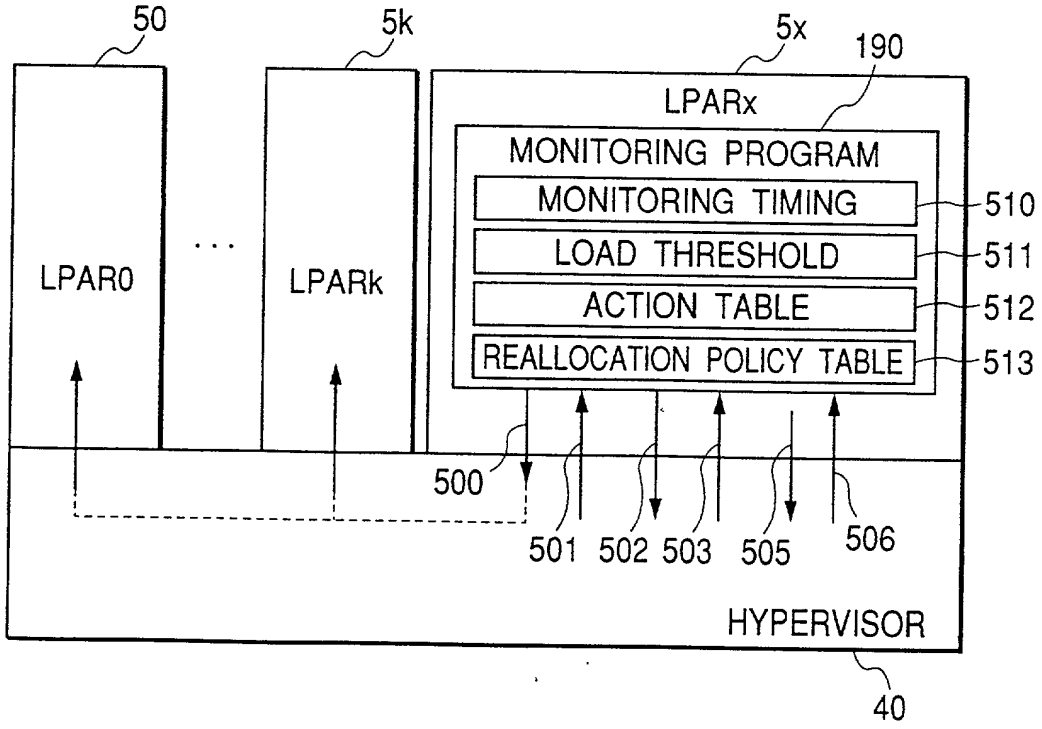


FIG. 20

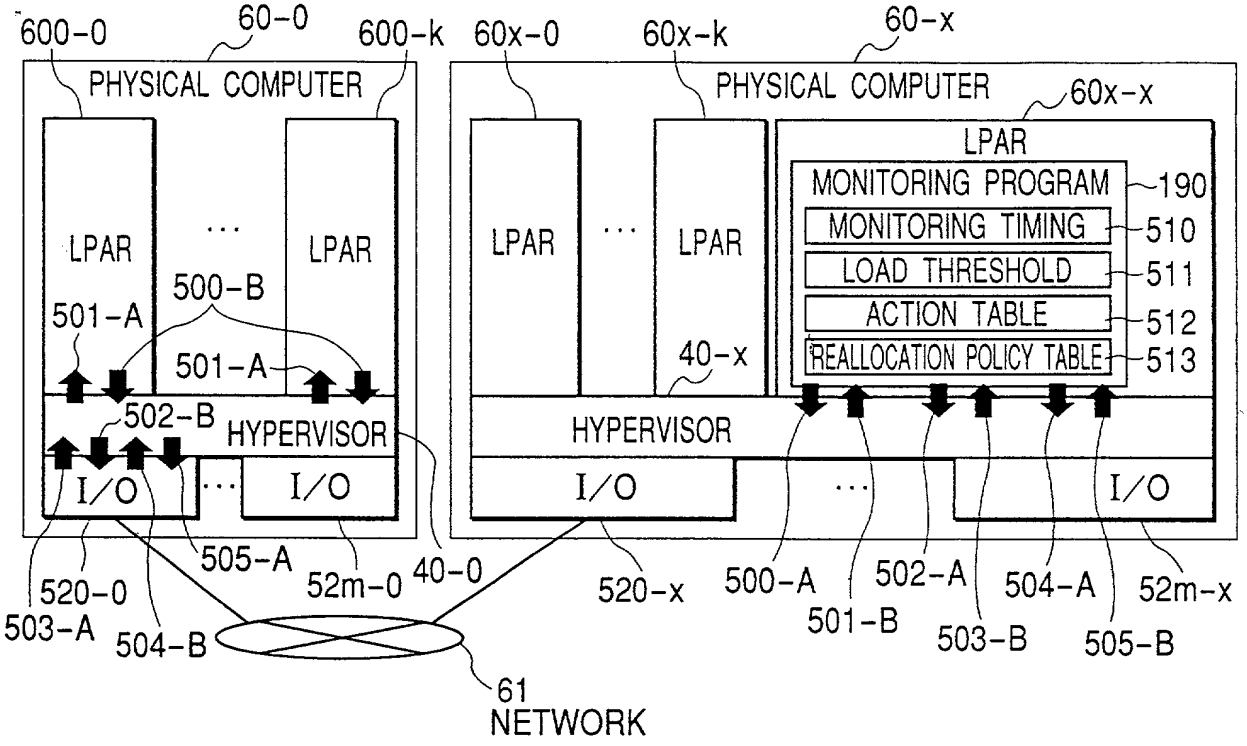

600-0
60-0
600-k
60x-0
60x-k
60-x
PHYSICAL COMPUTER
PHYSICAL COMPUTER
60x-x
LPAR
LPAR
LPAR
LPAR
LPAR
LPAR
MONITORING PROGRAM
190
MONITORING TIMING
510
LOAD THRESHOLD
511
ACTION TABLE
512
REALLOCATION POLICY TABLE
513
500-B
501-A
501-A
502-B
HYPERVISOR
40-x
HYPERVISOR
I/O
I/O
I/O
I/O
505-A
52m-0
40-0
520-x
500-A
502-A
504-A
52m-x
520-0
503-A
504-B
501-B
503-B
505-B
61
NETWORK

FIG. 21

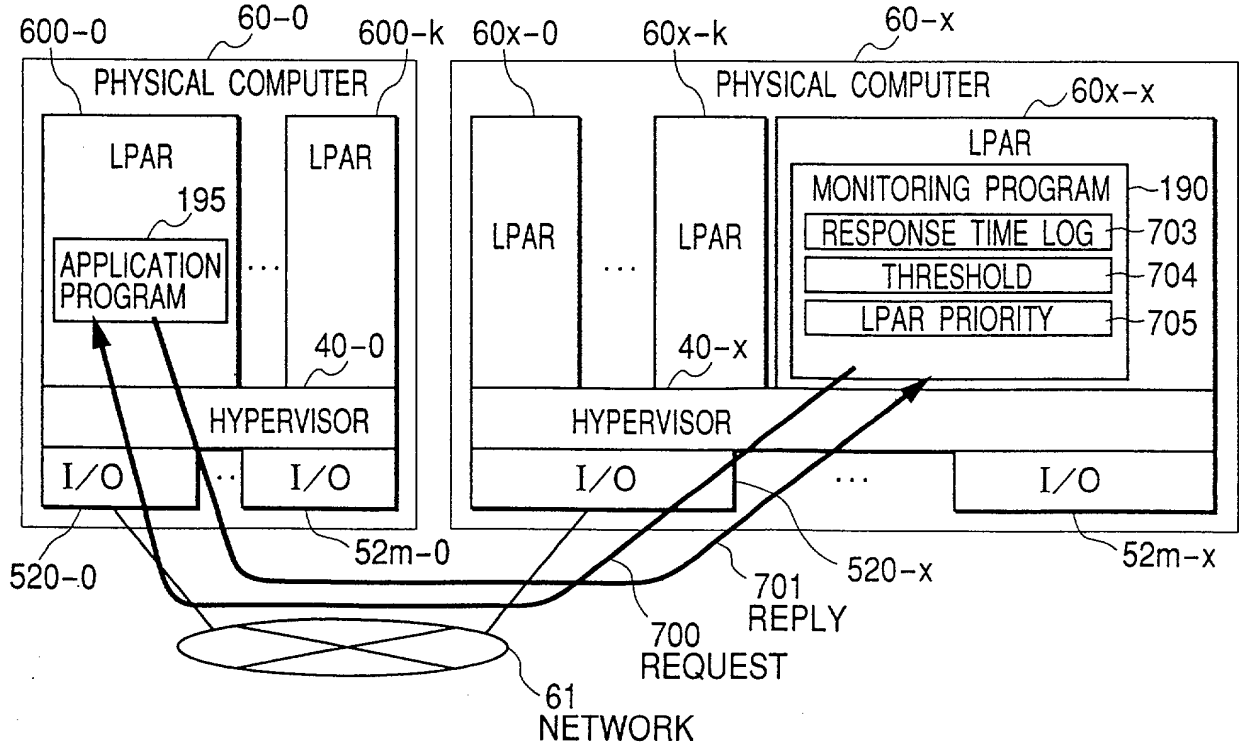

600-0
60-0
600-k
60x-0
60x-k
60-x
PHYSICAL COMPUTER
PHYSICAL COMPUTER
60x-x
LPAR
LPAR
LPAR
LPAR
LPAR
195
APPLICATION PROGRAM
MONITORING PROGRAM
190
RESPONSE TIME LOG
703
THRESHOLD
704
LPAR PRIORITY
705
40-0
40-x
HYPERVISOR
HYPERVISOR
I/O
I/O
I/O
I/O
52m-0
520-x
52m-x
520-0
701
REPLY
700
REQUEST
61
NETWORK

FIG. 22

PRIORITY	COUNTERMEASURES
1	INCREASE OF CPU ALLOCATION RATIO
2	INCREASE OF NUMBER OF CPUs
3	INCREASE OF MAIN MEMORY ALLOCATION
4	INCREASE OF SWAP AREA OF DISK
⋮	⋮

FIG. 23

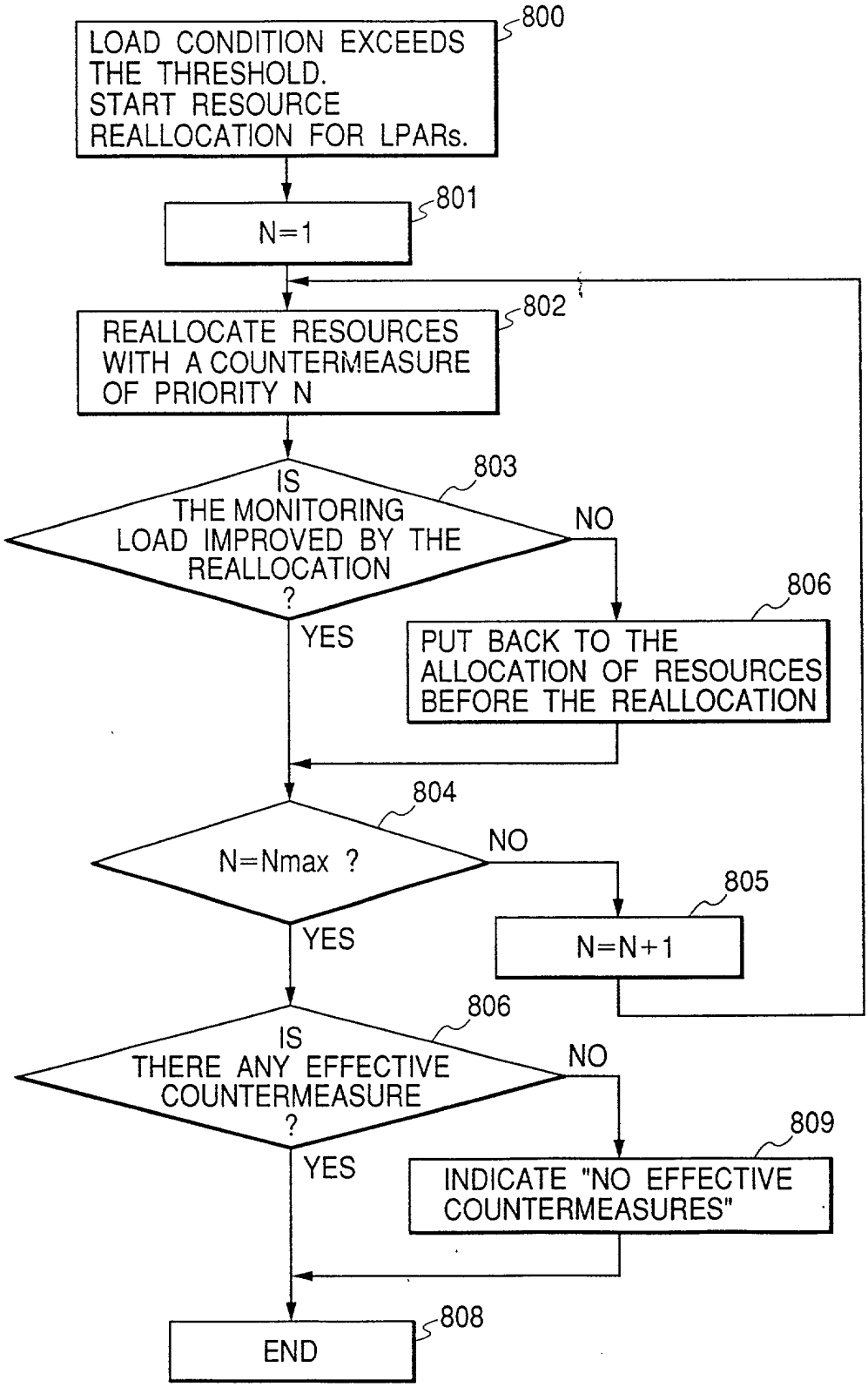

LOAD CONDITION EXCEEDS THE THRESHOLD. START RESOURCE REALLOCATION FOR LPARs.
800
N=1
801
REALLOCATE RESOURCES WITH A COUNTERMEASURE OF PRIORITY N
802
IS THE MONITORING LOAD IMPROVED BY THE REALLOCATION ?
803
NO
YES
PUT BACK TO THE ALLOCATION OF RESOURCES BEFORE THE REALLOCATION
806
N=Nmax ?
804
NO
YES
N=N+1
805
IS THERE ANY EFFECTIVE COUNTERMEASURE ?
806
NO
YES
INDICATE "NO EFFECTIVE COUNTERMEASURES"
809
END
808

FIG. 24

AGREEMENT CLASS 1000	AGREEMENT FEE 1001
A	PA
B	PB
C	PC

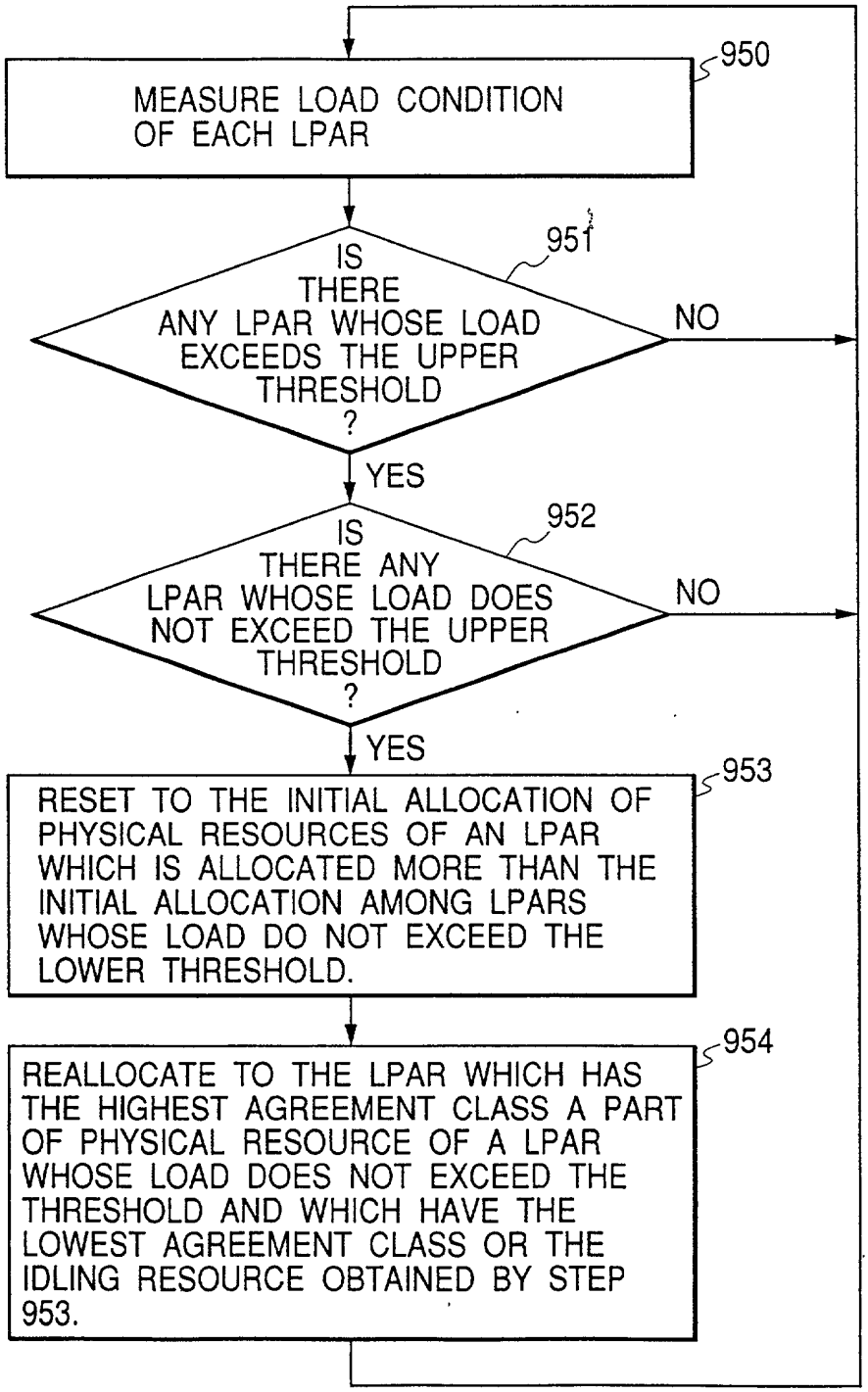
FIG. 25

AGREEMENT CLASS 1000	AGREEMENT FEE 1002	UPPER THRESHOLD 1003	LOWER THRESHOLD 1004
A	1	UTA	LTA
B	2	UTB	LTB
C	3	UTC	LTC

FIG. 26

CUSTOMER 1005	CUSTOMER'S AGREEMENT CLASS 1006	USING LPAR 1007
C0	B	LPAR0
C1	A	LPAR1
C2	C	LPAR2
C3	C	LPAR3

FIG. 27


950
MEASURE LOAD CONDITION OF EACH LPAR
951
IS THERE ANY LPAR WHOSE LOAD EXCEEDS THE UPPER THRESHOLD ?
NO
YES
952
IS THERE ANY LPAR WHOSE LOAD DOES NOT EXCEED THE UPPER THRESHOLD ?
NO
YES
953
RESET TO THE INITIAL ALLOCATION OF PHYSICAL RESOURCES OF AN LPAR WHICH IS ALLOCATED MORE THAN THE INITIAL ALLOCATION AMONG LPARS WHOSE LOAD DO NOT EXCEED THE LOWER THRESHOLD.
954
REALLOCATE TO THE LPAR WHICH HAS THE HIGHEST AGREEMENT CLASS A PART OF PHYSICAL RESOURCE OF A LPAR WHOSE LOAD DOES NOT EXCEED THE THRESHOLD AND WHICH HAVE THE LOWEST AGREEMENT CLASS OR THE IDLING RESOURCE OBTAINED BY STEP 953.